SEQUENCE LISTING

<110> Hammon, H. K.
      Insel, P. A.
      Ping, P.
      Post, S. R.
      Gao, M.

<120> GENE THERAPY FOR CONGESTIVE HEART
   FAILURE

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<141> 2000-12-26

<150> US 09/472,667
<151> 1999-12-27

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<151> 1998-01-16

<150> US 08/924,757
<151> 1997-09-05

<150> US 60/048,933
<151> 1997-06-16

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<151> 1996-09-05

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ccccgctata tgagctgcct ccgggatgca gagccaccca gccccacccc tgcgggcccc   180
cctcggtgcc cctggcagga tgacgccttc atccggaggg gcggcccang caagggcaag   240
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             20                  25                  30
Thr Arg Ala Gly Gly Phe Cys Thr Pro Arg Tyr Met Ser Cys Leu Arg
         35                  40                  45
Asp Ala Glu Pro Pro Ser Pro Thr Pro Ala Gly Pro Pro Arg Cys Pro
     50                  55                  60
Trp Gln Asp Asp Ala Phe Ile Arg Arg Gly Gly Pro Xaa Lys Gly Lys
65                  70                  75                  80
Glu Leu Gly Leu Arg Ala Val Ala Leu Gly Phe Glu Asp Thr Glu Val
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Thr Thr Thr Pro Ala Gly Pro Leu
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<210> 3
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<213> Homo sapiens

<400> 3
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gtgtctcagc gccaggcctt tcaggagacc cgcagttaca tccaggcccg gctccacctg   360
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cagaagcatg acaatgtcag catcctgttt gcagacattg agggcttcac cagcctggca   540
tcccagtgca ctgcgcagga gctggtcatg accctgaatg agctctttgc ccggtttgac   600
aagctggctg cggagaatca ctgcctgagg atcaagatct ggggggactg ttactactgt   660
gtgtcagggc tgccggaggc ccgggccgac catgcccact gctgtgtgga gatggggggta   720
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gatgcccgca gcattgatca gctgcggaag gaccatgtgc gccggttttt gctcaccttc  1320
cagagagagg attttgagaa gaagtactcc cggaaggtgg atccccgctt cggagcctac  1380
gttgcctgtg ccctgttggt cttctgcttc atctgcttca tccagcttct aattttccca  1440
cactccaccc tgatgcttgg gatttatgcc agcatcttcc tgctgctgct aatcaccgtg  1500
ctgatctgtg ctgtgtactc ctgtggttct ctgttcccta aggccctgca acgtctgtcc  1560
cgcagcattg tccgctcacg ggcacatagc accgcagttg gcatcttttc cgtcctgctt  1620
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gcagcccgga tgctgaattt aacacctgct gacatcactg cctgccacct gcagcagctc    1740
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cctgaggtgt tc                                                        1812
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<210> 4
<211> 604
<212> PRT
<213> Homo sapiens

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            20                  25                  30
Phe Phe Val Tyr Ile Ala Tyr Thr Leu Leu Pro Ile Arg Met Arg Ala
            35                  40                  45
Ala Val Leu Ser Gly Leu Gly Leu Ser Thr Leu His Leu Ile Leu Ala
            50                  55                  60
Trp Gln Leu Asn Arg Gly Asp Ala Phe Leu Trp Lys Gln Leu Gly Ala
65                  70                  75                  80
Asn Val Leu Leu Phe Leu Cys Thr Asn Val Ile Ser Ile Cys Thr His
                85                  90                  95
Tyr Pro Ala Glu Val Ser Gln Arg Gln Ala Phe Gln Glu Thr Arg Ser
            100                 105                 110
Tyr Ile Gln Ala Arg Leu His Leu Gln His Glu Asn Arg Gln Gln Glu
            115                 120                 125
Arg Leu Leu Leu Ser Val Leu Pro Gln His Val Ala Met Glu Met Lys
            130                 135                 140
Glu Asp Ile Asn Thr Lys Lys Glu Asp Met Phe His Lys Ile Tyr Ile
145                 150                 155                 160
Gln Lys His Asp Asn Val Ser Ile Leu Phe Ala Asp Ile Glu Gly Phe
                165                 170                 175
Thr Ser Leu Ala Ser Gln Cys Thr Ala Gln Glu Leu Val Met Thr Leu
            180                 185                 190
Asn Glu Leu Phe Ala Arg Phe Asp Lys Leu Ala Ala Glu Asn His Cys
            195                 200                 205
Leu Arg Ile Lys Ile Leu Gly Asp Cys Tyr Tyr Cys Val Ser Gly Leu
            210                 215                 220
Pro Glu Ala Arg Ala Asp His Ala His Cys Cys Val Glu Met Gly Val
225                 230                 235                 240
Asp Met Ile Glu Ala Ile Ser Leu Val Arg Glu Val Thr Gly Val Asn
                245                 250                 255
Val Asn Met Arg Val Gly Ile His Ser Gly Arg Val His Cys Gly Val
                260                 265                 270
Leu Gly Leu Arg Lys Trp Gln Phe Asp Val Trp Ser Asn Asp Val Thr
            275                 280                 285
Leu Ala Asn His Met Glu Ala Gly Ser Arg Ala Gly Arg Ile His Ile
            290                 295                 300
Thr Arg Ala Thr Leu Gln Tyr Leu Asn Gly Asp Tyr Glu Val Glu Pro
305                 310                 315                 320
Gly Arg Gly Gly Lys Arg Asn Ala Tyr Leu Lys Glu Gln His Ile Glu
                325                 330                 335
Thr Phe Leu Ile Leu Gly Ala Ser Gln Lys Arg Lys Glu Glu Lys Gly
                340                 345                 350
Met Leu Ala Lys Leu Gln Arg Thr Arg Ala Asn Ser Met Glu Gly Leu
            355                 360                 365
Met Pro Arg Trp Val Pro Asp Arg Ala Phe Ser Arg Thr Lys Asp Ser
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3

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         370                     375                     380
Lys Ala Phe Arg Gln Met Gly Ile Asp Asp Ser Ser Lys Asp Asn Arg
385                     390                     395                     400
Gly Thr Gln Asp Ala Leu Asn Pro Glu Asp Glu Val Asp Glu Phe Leu
                    405                     410                     415
Ser Arg Ala Ile Asp Ala Arg Ser Ile Asp Gln Leu Arg Lys Asp His
                    420                     425                     430
Val Arg Arg Phe Leu Leu Thr Phe Gln Arg Glu Asp Phe Glu Lys Lys
                    435                     440                     445
Tyr Ser Arg Lys Val Asp Pro Arg Phe Gly Ala Tyr Val Ala Cys Ala
                    450                     455                     460
Leu Leu Val Phe Cys Phe Ile Cys Phe Ile Gln Leu Leu Ile Phe Pro
465                     470                     475                     480
His Ser Thr Leu Met Leu Gly Ile Tyr Ala Ser Ile Phe Leu Leu Leu
                    485                     490                     495
Leu Ile Thr Val Leu Ile Cys Ala Val Tyr Ser Cys Gly Ser Leu Phe
                    500                     505                     510
Pro Lys Ala Leu Gln Arg Leu Ser Arg Ser Ile Val Arg Ser Arg Ala
                    515                     520                     525
His Ser Thr Ala Val Gly Ile Phe Ser Val Leu Leu Val Phe Thr Ser
                    530                     535                     540
Ala Ile Ala Asn Met Phe Thr Cys Asn His Thr Pro Ile Arg Ser Cys
545                     550                     555                     560
Ala Ala Arg Met Leu Asn Leu Thr Pro Ala Asp Ile Thr Ala Cys His
                    565                     570                     575
Leu Gln Gln Leu Asn Tyr Ser Leu Gly Leu Asp Ala Pro Leu Cys Glu
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<211> 3549
<212> DNA
<213> Homo sapiens

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ccccgctata tgagctgcct ccgggatgca gagccaccca gccccacccc tgcgggcccc    180
cctcggtgcc cctggcagga tgacgccttc atccggaggg gcggcccagg caagggcaag    240
gagctggggc tgcgggcagt ggccctgggc ttcgaggata ccgaggtgac aacgacagcg    300
ggcgggacgg ctgaggtggc gcccgacgcg gtgcccagga gtgggcgatc ctgctggcgc    360
cgtttggtgc aggtgttcca gtcgaagcag ttccgttcgg ccaagctgga cgcctgtac     420
cagcggtact tttttccagat gaaccagagc agcctgacgc tgctggtggc ggtgctggtg    480
ctgctcacag cggtgctgct ggctttccaa gccgcacccg cccgccctca gcctgcctat    540
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gtcattagca tctgcacaca ctatccagca gaggtgtctc agcgccaggc ctttcaggag    960
acccgcagtt acatccaggc ccggctccac ctgcagcatg agaatcggca gcaggagcgg   1020
ctgctgctgt cggtattgcc ccagcacgtt gccatggaga tgaaagaaga catcaacaca   1080
aaaaaagaag acatgttcca caagatctac atacagaagc atgacaatgt cagcatcctc   1140
tttgcagaca ttgagggctt caccagcctg gcatcccagt gcactgcgca ggagctggtc   1200
atgaccctga atgagctctt tgcccggttt gacaagctgg ctgcggagaa tcactgcctg   1260
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4

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cgtgaggtga caggtgtgaa tgtgaacatg cgcgtgggca tccacagcgg cgcgcgtgcac     1440
tgcggcgtcc ttggcttgcg gaaatggcag ttcgatgtgt ggtccaatga tgtgaccctg      1500
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gccgagtgcc tgcggctgct caacgagatc atcgctgact ttgatgagat tatcagcgag      3060
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<211> 1167
<212> PRT
<213> Homo sapiens

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            20   25   30
Thr Arg Ala Gly Gly Phe Cys Thr Pro Arg Tyr Met Ser Cys Leu Arg
        35   40   45
Asp Ala Glu Pro Pro Ser Pro Thr Pro Ala Gly Pro Pro Arg Cys Pro
    50   55   60
Trp Gln Asp Asp Ala Phe Ile Arg Arg Gly Gly Pro Gly Lys Gly Lys
65   70   75   80
Glu Leu Gly Leu Arg Ala Val Ala Leu Gly Phe Glu Asp Thr Glu Val

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                    85                      90                      95
Thr Thr Thr Ala Gly Gly Thr Ala Glu Val Ala Pro Asp Ala Val Pro
                   100                     105                     110
Arg Ser Gly Arg Ser Cys Trp Arg Arg Leu Val Gln Val Phe Gln Ser
                   115                     120                     125
Lys Gln Phe Arg Ser Ala Lys Leu Glu Arg Leu Tyr Gln Arg Tyr Phe
               130                     135                     140
Phe Gln Met Asn Gln Ser Ser Leu Thr Leu Leu Val Ala Val Leu Val
145                     150                     155                     160
Leu Leu Thr Ala Val Leu Leu Ala Phe Gln Ala Ala Pro Ala Arg Pro
                   165                     170                     175
Gln Pro Ala Tyr Val Ala Leu Leu Ala Cys Ala Ala Ala Leu Phe Val
               180                     185                     190
Gly Leu Met Val Val Cys Asn Arg His Ser Phe Arg Gln Asp Ser Met
           195                     200                     205
Trp Val Val Ser Asn Val Val Leu Gly Ile Leu Ala Ala Val Gln Val
       210                     215                     220
Gly Gly Ala Phe Ala Ala Asp Pro Arg Ser Pro Ser Ala Gly Leu Trp
225                     230                     235                     240
Cys Pro Val Phe Phe Val Tyr Ile Ala Tyr Thr Leu Leu Pro Ile Arg
                   245                     250                     255
Met Arg Ala Ala Val Leu Ser Gly Leu Gly Leu Ser Thr Leu His Leu
                   260                     265                     270
Ile Leu Ala Trp Gln Leu Asn Arg Gly Asp Ala Phe Leu Trp Lys Gln
           275                     280                     285
Leu Gly Ala Asn Val Leu Leu Phe Leu Cys Thr Asn Val Ile Ser Ile
       290                     295                     300
Cys Thr His Tyr Pro Ala Glu Val Ser Gln Arg Gln Ala Phe Gln Glu
305                     310                     315                     320
Thr Arg Ser Tyr Ile Gln Ala Arg Leu His Leu Gln His Glu Asn Arg
                   325                     330                     335
Gln Gln Glu Arg Leu Leu Leu Ser Val Leu Pro Gln His Val Ala Met
               340                     345                     350
Glu Met Lys Glu Asp Ile Asn Thr Lys Lys Glu Asp Met Phe His Lys
           355                     360                     365
Ile Tyr Ile Gln Lys His Asp Asn Val Ser Ile Leu Phe Ala Asp Ile
       370                     375                     380
Glu Gly Phe Thr Ser Leu Ala Ser Gln Cys Thr Ala Gln Glu Leu Val
385                     390                     395                     400
Met Thr Leu Asn Glu Leu Phe Ala Arg Phe Asp Lys Leu Ala Ala Glu
                   405                     410                     415
Asn His Cys Leu Arg Ile Lys Ile Leu Gly Asp Cys Tyr Tyr Cys Val
               420                     425                     430
Ser Gly Leu Pro Glu Ala Arg Ala Asp His Ala His Cys Cys Val Glu
           435                     440                     445
Met Gly Val Asp Met Ile Glu Ala Ile Ser Leu Val Arg Glu Val Thr
       450                     455                     460
Gly Val Asn Val Asn Met Arg Val Gly Ile His Ser Gly Arg Val His
465                     470                     475                     480
Cys Gly Val Leu Gly Leu Arg Lys Trp Gln Phe Asp Val Trp Ser Asn
                   485                     490                     495
Asp Val Thr Leu Ala Asn His Met Glu Ala Gly Ser Arg Ala Gly Arg
               500                     505                     510
Ile His Ile Thr Arg Ala Thr Leu Gln Tyr Leu Asn Gly Asp Tyr Glu
           515                     520                     525
Val Glu Pro Gly Arg Gly Gly Lys Arg Asn Ala Tyr Leu Lys Glu Gln
       530                     535                     540
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6

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His Ile Glu Thr Phe Leu Ile Leu Gly Ala Ser Gln Lys Arg Lys Glu
545                 550                 555                 560
Glu Lys Gly Met Leu Ala Lys Leu Gln Arg Thr Arg Ala Asn Ser Met
                565                 570                 575
Glu Gly Leu Met Pro Arg Trp Val Pro Asp Arg Ala Phe Ser Arg Thr
                580                 585                 590
Lys Asp Ser Lys Ala Phe Arg Gln Met Gly Ile Asp Asp Ser Ser Lys
            595                 600                 605
Asp Asn Arg Gly Thr Gln Asp Ala Leu Asn Pro Glu Asp Glu Val Asp
        610                 615                 620
Glu Phe Leu Ser Arg Ala Ile Asp Ala Arg Ser Ile Asp Gln Leu Arg
625                 630                 635                 640
Lys Asp His Val Arg Arg Phe Leu Leu Thr Phe Gln Arg Glu Asp Phe
                645                 650                 655
Glu Lys Lys Tyr Ser Arg Lys Val Asp Pro Arg Phe Gly Ala Tyr Val
                660                 665                 670
Ala Cys Ala Leu Leu Val Phe Cys Phe Ile Cys Phe Ile Gln Leu Leu
            675                 680                 685
Ile Phe Pro His Ser Thr Leu Met Leu Gly Ile Tyr Ala Ser Ile Phe
        690                 695                 700
Leu Leu Leu Leu Ile Thr Val Leu Ile Cys Ala Val Tyr Ser Cys Gly
705                 710                 715                 720

Ser Leu Phe Pro Lys Ala Leu Gln Arg Leu Ser Arg Ser Ile Val Arg
                725                 730                 735
Ser Arg Ala His Ser Thr Ala Val Gly Ile Phe Ser Val Leu Leu Val
                740                 745                 750
Phe Thr Ser Ala Ile Ala Asn Met Phe Thr Cys Asn His Thr Pro Ile
            755                 760                 765
Arg Ser Cys Ala Ala Arg Met Leu Asn Leu Thr Pro Ala Asp Ile Thr
        770                 775                 780
Ala Cys His Leu Gln Gln Leu Asn Tyr Ser Leu Gly Leu Asp Ala Pro
785                 790                 795                 800
Leu Cys Glu Gly Thr Met Pro Thr Cys Ser Phe Pro Glu Val Ser Ile
                805                 810                 815
Gly Asn Met Leu Leu Ser Leu Leu Ala Ser Ser Val Phe Leu His Ile
            820                 825                 830
Ser Ser Ile Gly Lys Leu Ala Met Ile Phe Val Leu Gly Leu Ile Tyr
            835                 840                 845
Leu Val Leu Leu Leu Leu Gly Pro Pro Ala Ala Ile Phe Asp Asn Tyr
        850                 855                 860
Asp Leu Leu Leu Gly Val His Gly Leu Ala Ser Ser Asn Glu Thr Phe
865                 870                 875                 880
Asp Gly Leu Asp Cys Pro Ala Ala Gly Arg Val Ala Leu Lys Tyr Met
            885                 890                 895
Thr Pro Val Ile Leu Leu Val Phe Ala Leu Ala Leu Tyr Leu His Ala
            900                 905                 910
Gln Gln Val Glu Ser Thr Ala Arg Leu Asn Phe Leu Trp Lys Leu Gln
        915                 920                 925
Ala Thr Gly Glu Lys Glu Glu Met Glu Glu Leu Gln Ala Tyr Asn Arg
        930                 935                 940
Arg Leu Leu His Asn Ile Leu Pro Lys Asp Val Ala Ala His Phe Leu
945                 950                 955                 960
Ala Arg Glu Arg Arg Asn Asp Glu Leu Tyr Tyr Gln Ser Cys Glu Cys
                965                 970                 975
Val Ala Val Met Phe Ala Ser Ile Ala Asn Phe Ser Glu Phe Tyr Val
            980                 985                 990
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7

Glu Leu Glu Ala Asn Asn Glu Gly Ala Glu Cys Leu Arg Leu Leu Asn
         995   1000   1005
Glu Ile Ile Ala Asp Phe Asp Glu Ile Ile Ser Glu Glu Arg Phe Arg
      1010   1015   ·1020
Gln Leu Glu Lys Ile Lys Thr Ile Gly Ser Thr Tyr Met Ala Ala Ser
1025   1030   1035   1040
Gly Leu Asn Ala Ser Thr Tyr Asp Gln Val Gly Arg Ser His Ile Thr
         1045   1050   1055
Ala Leu Ala Asp Tyr Ala Met Arg Leu Met Glu Gln Met Lys His Ile
         1060   1065   1070
Asn Glu His Ser Phe Asn Asn Phe Gln Met Lys Ile Gly Leu Asn Met
         1075   1080   1085
Gly Pro Val Val Ala Gly Val Ile Gly Ala Arg Lys Pro Gln Tyr Asp
      1090   1095   1100
Ile Trp Gly Asn Thr Val Asn Val Ser Ser Arg Met Asp Ser Thr Gly
1105   1110   1115   1120
Val Pro Asp Arg Ile Gln Val Thr Thr Asp Leu Tyr Gln Val Leu Ala
         1125   1130 ·   1135
Ala Lys Gly Tyr Gln Leu Glu Cys Arg Gly Val Val Lys Val Lys Gly
         1140   1145   1150
Lys Gly Glu Met Thr Thr Tyr Phe Leu Asn Gly Gly Pro Ser Ser
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<210> 7
<211> 28
<212> DNA
<213> Cavia porcellus

<400> 7
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<210> 8
<211> 29
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<213> Cavia porcellus

<400> 8
acgttaagct tccasacrtc raaytgcca   29

<210> 9
<211> 9
<212> RNA
<213> Artificial Sequence

<220>
<223> Modified AC-VI

<400> 9
uuauuuaww   9

<210> 10
<211> 3552
<212> DNA
<213> Homo sapiens

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ggggtccccg accgaatcca ggtgaccacg gacctgtacc aggttctagc tgccaagggc   3420
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9

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<211> 1168
<212> PRT
<213> Homo sapiens

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Thr Arg Ala Gly Gly Phe Cys Thr Pro Arg Tyr Met Ser Cys Leu Arg
        35   40   45
Asp Ala Glu Pro Pro Ser Pro Thr Pro Ala Gly Pro Pro Arg Cys Pro
        50   55   60
Trp Gln Asp Asp Ala Phe Ile Arg Arg Gly Gly Pro Gly Lys Gly Lys
65   70   75   80
Glu Leu Gly Leu Arg Ala Val Ala Leu Gly Phe Glu Asp Thr Glu Val
                85   90   95
Thr Thr Thr Ala Gly Gly Thr Ala Glu Val Ala Pro Asp Ala Val Pro
            100   105   110
Arg Ser Gly Arg Ser Cys Trp Arg Arg Leu Val Gln Val Phe Gln Ser
        115   120   125
Lys Gln Phe Arg Ser Ala Lys Leu Glu Arg Leu Tyr Gln Arg Tyr Phe
    130   135   140
Phe Gln Met Asn Gln Ser Ser Leu Thr Leu Leu Met Ala Val Leu Val
145   150   155   160
Leu Leu Thr Ala Val Leu Leu Ala Phe His Ala Ala Pro Ala Arg Pro
                165   170   175
Gln Pro Ala Tyr Val Ala Leu Leu Ala Cys Ala Ala Ala Leu Phe Val
            180   185   190
Gly Leu Met Val Val Cys Asn Arg His Ser Phe Arg Gln Asp Ser Met
        195   200   205

Trp Val Val Ser Tyr Val Val Leu Gly Ile Leu Ala Ala Val Gln Val
    210   215   220
Gly Gly Ala Leu Ala Ala Asp Pro Arg Ser Pro Ser Ala Gly Leu Trp
225   230   235   240
Cys Pro Val Phe Phe Val Tyr Ile Ala Tyr Thr Leu Leu Pro Ile Arg
                245   250   255
Met Arg Ala Ala Val Leu Ser Gly Leu Gly Leu Ser Thr Leu His Leu
            260   265   270
Ile Leu Ala Trp Gln Leu Asn Arg Gly Asp Ala Phe Leu Trp Lys Gln
        275   280   285
Leu Gly Ala Asn Val Leu Leu Phe Leu Cys Thr Asn Val Ile Gly Ile
    290   295   300
Cys Thr His Tyr Pro Ala Glu Val Ser Gln Arg Gln Ala Phe Gln Glu
305   310   315   320
Thr Arg Gly Tyr Ile Gln Ala Arg Leu His Leu Gln His Glu Asn Arg
                325   330   335
Gln Gln Glu Arg Leu Leu Leu Ser Val Leu Pro Gln His Val Ala Met
            340   345   350
Glu Met Lys Glu Asp Ile Asn Thr Lys Lys Glu Asp Met Met Phe His
        355   360   365
Lys Ile Tyr Ile Gln Lys His Asp Asn Val Ser Ile Leu Phe Ala Asp

10

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              370                        375                        380
Ile Glu Gly Phe Thr Ser Leu Ala Ser Gln Cys Thr Ala Gln Glu Leu
385                        390                        395                        400
Val Met Thr Leu Asn Glu Leu Phe Ala Arg Phe Asp Lys Leu Ala Ala
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Glu Asn His Cys Leu Arg Ile Lys Ile Leu Gly Asp Cys Tyr Tyr Cys
              420                        425                        430
Val Ser Gly Leu Pro Glu Ala Arg Ala Asp His Ala His Cys Cys Val
              435                        440                        445
Glu Met Gly Val Asp Met Ile Glu Ala Ile Ser Leu Val Arg Glu Val
         450                        455                        460
Thr Gly Val Asn Val Asn Met Arg Val Gly Ile His Ser Gly Arg Val
465                        470                        475                        480
His Cys Gly Val Leu Gly Leu Arg Lys Trp Gln Phe Asp Val Trp Ser
                   485                        490                        495
Asn Asp Val Thr Leu Ala Asn His Met Glu Ala Gly Gly Arg Ala Gly
              500                        505                        510
Arg Ile His Ile Thr Arg Ala Thr Leu Gln Tyr Leu Asn Gly Asp Tyr
              515                        520                        525
Glu Val Glu Pro Gly Arg Gly Gly Glu Arg Asn Ala Tyr Leu Lys Glu
         530                        535                        540
Gln His Ile Glu Thr Phe Leu Ile Leu Gly Ala Ser Gln Lys Arg Lys
545                        550                        555                        560
Glu Glu Lys Ala Met Leu Ala Lys Leu Gln Arg Thr Arg Ala Asn Ser
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Met Glu Gly Leu Met Pro Arg Trp Val Pro Asp Arg Ala Phe Ser Arg
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Thr Lys Asp Ser Lys Ala Phe Arg Gln Met Gly Ile Asp Asp Ser Ser
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Lys Asp Asn Arg Gly Thr Gln Asp Ala Leu Asn Pro Glu Asp Glu Val
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Asp Glu Phe Leu Ser Arg Ala Ile Asp Ala Arg Ser Ile Asp Gln Leu
625                        630                        635                        640
Arg Lys Asp His Val Arg Arg Phe Leu Leu Thr Phe Gln Arg Glu Asp
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Leu Glu Lys Lys Tyr Ser Arg Lys Val Asp Pro Arg Phe Gly Ala Tyr
              660                        665                        670
Val Ala Cys Ala Leu Leu Val Phe Cys Phe Ile Cys Phe Ile Gln Leu
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Leu Ile Phe Pro His Ser Thr Leu Met Leu Gly Ile Tyr Ala Ser Ile
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Phe Leu Leu Leu Leu Ile Thr Val Leu Ile Cys Ala Val Tyr Ser Cys
705                        710                        715                        720
Gly Ser Leu Phe Pro Lys Ala Leu Gln Arg Leu Ser Arg Ser Ile Val
              725                        730                        735
Arg Ser Arg Ala His Ser Thr Ala Val Gly Ile Phe Ser Val Leu Leu
              740                        745                        750
Val Phe Thr Ser Ala Ile Ala Asn Met Phe Thr Cys Asn His Thr Pro
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Ile Arg Ser Cys Ala Ala Arg Met Leu Asn Leu Thr Pro Ala Asp Ile
         770                        775                        780
Thr Ala Cys His Leu Gln Gln Leu Asn Tyr Ser Leu Gly Leu Asp Ala
785                        790                        795                        800
Pro Leu Cys Glu Gly Thr Met Pro Thr Cys Ser Phe Pro Glu Tyr Phe
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Ile Gly Asn Met Leu Leu Ser Leu Leu Ala Ser Ser Val Phe Leu His
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Tyr Leu Val Leu Leu Leu Leu Gly Pro Pro Ala Thr Ile Phe Asp Asn
        850                     855                 860
Tyr Asp Leu Leu Leu Gly Val His Gly Leu Ala Ser Ser Asn Glu Thr
865                         870                 875                 880
Phe Asp Gly Leu Asp Cys Pro Ala Ala Gly Arg Val Ala Leu Lys Tyr
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Met Thr Pro Val Ile Leu Leu Val Phe Ala Leu Ala Leu Tyr Leu His
                900                     905                 910
Ala Gln Gln Val Glu Ser Thr Ala Arg Leu Asp Phe Leu Trp Lys Leu
        915                     920                 925
Gln Ala Thr Gly Glu Lys Glu Glu Met Glu Glu Leu Gln Ala Tyr Asn
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Arg Arg Leu Leu His Asn Ile Leu Pro Lys Asp Val Ala Ala His Phe
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Leu Ala Arg Glu Arg Arg Asn Asp Glu Leu Tyr Tyr Gln Ser Cys Glu
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Cys Val Ala Val Met Phe Ala Ser Ile Ala Asn Phe Ser Glu Phe Tyr
                980                     985                 990
Val Glu Leu Glu Ala Asn Asn Glu Gly Val Glu Cys Leu Arg Leu Leu
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Asn Glu Ile Ile Ala Asp Phe Asp Glu Ile Ile Ser Glu Glu Arg Phe
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Arg Gln Leu Glu Lys Ile Lys Thr Ile Gly Ser Thr Tyr Met Ala Ala
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Ser Gly Leu Asn Ala Ser Thr Tyr Asp Gln Val Gly Arg Ser His Ile
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Thr Ala Leu Ala Asp Tyr Ala Met Arg Leu Met Glu Gln Met Lys His
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Ile Asn Glu His Ser Phe Asn Asn Phe Gln Met Lys Ile Gly Leu Asn
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Met Gly Pro Val Val Ala Gly Val Ile Gly Ala Arg Lys Pro Gln Tyr
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Asp Ile Trp Gly Asn Thr Val Asn Val Ser Ser Arg Met Asp Ser Thr
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Gly Val Pro Asp Arg Ile Gln Val Thr Thr Asp Leu Tyr Gln Val Leu
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Ala Ala Lys Gly Tyr Gln Leu Glu Cys Arg Gly Val Val Lys Val Lys
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Gly Lys Gly Glu Met Thr Thr Tyr Phe Leu Asn Gly Gly Pro Ser Ser
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<211> 3582
<212> DNA
<213> Artificial Sequence

<220>
<223> Modified AC-VI

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ggggagatga ccacctactt cctcaatggg ggccccagca gttaacaggg cccagccaca       3540
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<211> 1167
<212> PRT
<213> Artificial Sequence

<220>
<223> Modified AC-VI

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            20   25   30
Thr Arg Ala Gly Gly Phe Cys Thr Pro Arg Tyr Met Ser Cys Leu Arg
        35   40   45
Asp Ala Glu Pro Pro Ser Pro Thr Pro Ala Gly Pro Pro Arg Cys Pro
    50   55   60
Trp Gln Asp Asp Ala Phe Ile Arg Arg Gly Gly Pro Gly Lys Gly Lys
65   70   75   80
Glu Leu Gly Leu Arg Ala Val Ala Leu Gly Phe Glu Asp Thr Glu Val
            85   90   95
Thr Thr Thr Ala Gly Gly Thr Ala Glu Val Ala Pro Asp Ala Val Pro
            100   105   110
Arg Ser Gly Arg Ser Cys Trp Arg Arg Leu Val Gln Val Phe Gln Ser
        115   120   125
Lys Gln Phe Arg Ser Ala Lys Leu Glu Arg Leu Tyr Gln Arg Tyr Phe
    130   135   140
Phe Gln Met Asn Gln Ser Ser Leu Thr Leu Leu Met Ala Val Leu Val
145   150   155   160
Leu Leu Thr Ala Val Leu Leu Ala Phe His Ala Ala Pro Ala Arg Pro
                165   170   175
Gln Pro Ala Tyr Val Ala Leu Leu Ala Cys Ala Ala Ala Leu Phe Val
            180   185   190
Gly Leu Met Val Val Cys Asn Arg His Ser Phe Arg Gln Asp Ser Met
        195   200   205
Trp Val Val Ser Tyr Val Val Leu Gly Ile Leu Ala Ala Val Gln Val
    210   215   220
Gly Gly Ala Leu Ala Ala Asp Pro Arg Ser Pro Ser Ala Gly Leu Trp
225   230   235   240
Cys Pro Val Phe Phe Val Tyr Ile Ala Tyr Thr Leu Leu Pro Ile Arg
                245   250   255
Met Arg Ala Ala Val Leu Ser Gly Leu Gly Leu Ser Thr Leu His Leu
                260   265   270
Ile Leu Ala Trp Gln Leu Asn Arg Gly Asp Ala Phe Leu Trp Lys Gln
            275   280   285
Leu Gly Ala Asn Val Leu Leu Phe Leu Cys Thr Asn Val Ile Gly Ile
    290   295   300
Cys Thr His Tyr Pro Ala Glu Val Ser Gln Arg Gln Ala Phe Gln Glu
305   310   315   320
Thr Arg Gly Tyr Ile Gln Ala Arg Leu His Leu Gln His Glu Asn Arg
                325   330   335

Gln Gln Glu Arg Leu Leu Leu Ser Val Leu Pro Gln His Val Ala Met
            340   345   350

Glu Met Lys Glu Asp Ile Asn Thr Lys Lys Glu Asp Met Met Phe His
            355   360   365
Lys Ile Tyr Ile Gln Lys His Asp Asn Val Ser Ile Leu Phe Ala Asp

14

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Ile Glu Gly Phe Thr Ser Leu Ala Ser Gln Cys Thr Ala Gln Glu Leu
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Val Met Thr Leu Asn Glu Leu Phe Ala Arg Phe Asp Lys Leu Ala Ala
                405                     410                     415
Glu Asn His Cys Leu Arg Ile Lys Ile Leu Gly Asp Cys Tyr Tyr Cys
                420                     425                     430
Val Ser Gly Leu Pro Glu Ala Arg Ala Asp His Ala His Cys Cys Val
                435                     440                     445
Glu Met Gly Val Asp Met Ile Glu Ala Ile Ser Leu Val Arg Glu Val
450                     455                     460
Thr Gly Val Asn Val Asn Met Arg Val Gly Ile His Ser Gly Arg Val
465                     470                     475                     480
His Cys Gly Val Leu Gly Leu Arg Lys Trp Gln Phe Asp Val Trp Ser
                485                     490                     495
Asn Asp Val Thr Leu Ala Asn His Met Glu Ala Gly Gly Gly Arg Arg
                500                     505                     510
Ile His Ile Thr Arg Ala Thr Leu Gln Tyr Leu Asn Gly Asp Tyr Glu
                515                     520                     525
Val Glu Pro Gly Arg Gly Gly Glu Arg Asn Ala Tyr Leu Lys Glu Gln
530                     535                     540
Cys Ile Glu Thr Phe Leu Ile Leu Gly Ala Ser Gln Lys Arg Lys Glu
545                     550                     555                     560
Glu Lys Ala Met Leu Ala Lys Leu Gln Arg Thr Arg Ala Asn Ser Met
                565                     570                     575
Glu Gly Leu Met Pro Arg Trp Val Pro Asp Arg Ala Phe Ser Arg Thr
                580                     585                     590
Lys Asp Ser Lys Ala Phe Arg Gln Met Gly Ile Asp Asp Ser Ser Lys
                595                     600                     605
Asp Asn Arg Gly Ala Gln Asp Ala Leu Asn Pro Glu Asp Glu Val Asp
        610                     615                     620
Glu Phe Leu Gly Arg Ala Ile Asp Ala Arg Ser Ile Asp Gln Leu Arg
625                     630                     635                     640
Lys Asp His Val Arg Arg Phe Leu Leu Thr Phe Gln Arg Glu Asp Leu
                645                     650                     655
Glu Lys Lys Tyr Ser Arg Lys Val Asp Pro Arg Phe Gly Ala Tyr Val
                660                     665                     670
Ala Cys Ala Leu Leu Val Phe Cys Phe Ile Cys Phe Ile Gln Leu Leu
                675                     680                     685
Ile Phe Pro His Ser Thr Leu Met Leu Gly Ile Tyr Ala Ser Ile Phe
        690                     695                     700
Leu Leu Leu Leu Ile Thr Val Leu Ile Cys Ala Val Tyr Ser Cys Gly
705                     710                     715                     720
Ser Leu Phe Pro Lys Ala Leu Gln Arg Leu Ser Arg Ser Ile Val Arg
                725                     730                     735
Ser Arg Ala His Ser Thr Ala Val Gly Ile Phe Ser Val Leu Leu Val
                740                     745                     750
Phe Thr Ser Ala Ile Ala Asn Met Phe Thr Cys Asn His Thr Pro Ile
                755                     760                     765
Arg Ser Cys Ala Ala Arg Met Leu Asn Leu Thr Pro Ala Asp Ile Thr
        770                     775                     780
Ala Cys His Leu Gln Gln Leu Asn Tyr Ser Leu Gly Leu Asp Ala Pro
785                     790                     795                     800
Leu Cys Glu Gly Thr Met Pro Thr Cys Ser Phe Pro Glu Tyr Phe Ile
                805                     810                     815
Gly Asn Met Leu Leu Ser Leu Leu Ala Ser Ser Val Phe Leu His Ile
                820                     825                     830
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Ser Ser Ile Gly Lys Leu Ala Met Ile Phe Val Leu Gly Leu Ile Tyr
        835                 840                 845
Leu Val Leu Leu Leu Leu Gly Pro Pro Ala Thr Ile Phe Asp Asn Tyr
        850             855             860
Asp Leu Leu Leu Gly Val His Gly Leu Ala Ser Ser Asn Glu Thr Phe
865                 870                 875                 880
Asp Gly Leu Asp Cys Pro Ala Ala Gly Arg Val Ala Leu Lys Tyr Met
                885                 890                 895
Thr Pro Val Ile Leu Leu Val Phe Ala Leu Ala Leu Tyr Leu His Ala
            900                 905                 910
Gln Gln Val Glu Ser Thr Ala Arg Leu Asp Phe Leu Trp Lys Leu Gln
        915                 920                 925
Ala Thr Gly Glu Lys Glu Glu Met Glu Glu Leu Gln Ala Tyr Asn Arg
        930                 935                 940
Arg Leu Leu His Asn Ile Leu Pro Lys Asp Val Ala Ala His Phe Leu
945                 950                 955                 960
Ala Arg Glu Arg Arg Asn Asp Glu Leu Tyr Tyr Gln Ser Cys Glu Cys
                965                 970                 975
Val Ala Val Met Phe Ala Ser Ile Ala Asn Phe Ser Glu Phe Tyr Val
                980                 985                 990
Glu Leu Glu Ala Asn Asn Glu Gly Val Glu Cys Leu Arg Leu Leu Asn
        995                 1000                1005
Glu Ile Ile Ala Asp Phe Asp Glu Ile Ile Ser Glu Glu Arg Phe Arg
        1010                1015                1020
Gln Leu Glu Lys Ile Lys Thr Ile Gly Ser Thr Tyr Met Ala Ala Ser
1025                1030                1035                1040
Gly Leu Asn Ala Ser Thr Tyr Asp Gln Val Gly Arg Ser His Ile Thr
                1045                1050                1055
Ala Leu Ala Asp Tyr Ala Met Arg Leu Met Glu Gln Met Lys His Ile
                1060                1065                1070
Asn Glu His Ser Phe Asn Asn Phe Gln Met Lys Ile Gly Leu Asn Met
                1075                1080                1085
Gly Pro Val Val Ala Gly Val Ile Gly Ala Arg Lys Pro Gln Tyr Asp
        1090                1095                1100
Ile Trp Gly Asn Thr Val Asn Val Ser Ser Arg Met Asp Ser Thr Gly
1105                1110                1115                1120
Val Pro Asp Arg Ile Gln Val Thr Thr Asp Leu Tyr Gln Val Leu Ala
                1125                1130                1135
Ala Lys Gly Tyr Gln Leu Glu Cys Arg Gly Val Val Lys Val Lys Gly
                1140                1145                1150
Lys Gly Glu Met Thr Thr Tyr Phe Leu Asn Gly Gly Pro Ser Ser
        1155                1160                1165
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